**SEARCH FOR ALPHA-CONDENSATE EFFECTS IN DISSOSIASION OF RELATIVISTIC NUCLEI**

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The BECQUEREL experiment is aimed at solving topical problems in nuclear cluster physics [1]. Due to its unique sensitivity and spatial resolution the used method of nuclear track emulsion (NTE) makes it possible, to study in a unified approach multiple final states arising in the dissociation of relativistic nuclei. The focus is a concept of α-particle Bose-Einstein condensate (αBEC) - the extremely cold state of several S-wave α-particles near the coupling threshold. The unstable 8Be nucleus is described as 2αBEC, and the 12C(0+2) excitation or Hoyle state (HS) as 3αBEC. The state 16O(0+6) above the 4α threshold, considered as 4αBEC, can sequentially decay 16O(0+6) → α12C(0+2) or 16O(0+6) → 28Be(0+).

In NTE layers longitudinally exposed to relativistic nuclei the invariant mass of ensembles of He and H fragments can be determined from the emission angles in the approximation of conservation of initial momentum per nucleon. 8Be and HS decays, as well as 9B → 8Be*p* decays, are identified in fragmentation of light nuclei by an upper constraint on the invariant mass [2]. Photos and videos of characteristic interactions are available on the site <http://becquerel.jinr.ru/>. This approach has been used to identify 8Be and HS and search for more complex states of αBEC in fragmentation of medium and heavy nuclei. Recently, based on the statistics of dozens of 8Be decays, an enhancement in the probability of detecting 8Be in an event with an increase in the number of relativistic α-particles in it was found [3]. A preliminary conclusion is drawn that the contributions from 9B and HS decays also increase. The exotically large sizes and lifetimes of 8Be and HS suggest the possibility of synthesizing αBEC by successively connecting the emerging α-particles 2α → 8Be, 8Beα → 12C(0+2), 12C(0+2)α → 16O(0+6), 28Be → 16O(0+6) and further with a decreasing probability at each step, when γ-quanta or recoil particles are emitted. Nowadays, the main task is to clarify the relation between the appearance of 8Be and HS and the multiplicity of α-ensembles and to search on this basis for decays of the 16O(0+6) state. In this regard, the BECQUEREL experiment aims to measure multiple channels of 84Kr fragmentation at energies up to 950 MeV per nucleon. There are a sufficient number of NTE layers, the transverse scanning of which on a motorized microscope makes it possible to achieve the required statistics. A status of the ongoing research is presented.

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2. D.A. Artemenkov *et al.*, Eur. Phys. J. A56 (2020) 250; DOI: 10.1140/epja/s10050-020-00252-3, arXiv: 2004.10277.

3. A.A. Zaitsev *et al*., Phys. Lett.B820 (2021) 136460; DOI 10.1016/j.physletb.2021.136460, arXiv: 2102.09541.